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NAVIGATION SYSTEM FOR INTERPLANETARY MISSIONS

Abstract

There are no navigational reference points in interplanetary space. The stars are excellent landmarks, but they are too far from the Solar system and can only be used to determine the space probe's spatial orientation. To ensure space probe flight within the Solar system, it is necessary to measure the exact position of the space probe in the heliocentric coordinate systems. The spatial position of the space probe can be approximately determined by measuring the distance to the space probe by radio equipment — for example, by the arrival time of the answering repeater signal with a calibrated auto-response time, and more accurately - by measuring the directions to the space probe, for example, using Very Long Baseline Interferometry, VLBI, from spaced measurement points. It is proposed to create a navigation system inside the Solar system by placing navigation beacons spaced at distances comparable to the size of the planetary orbits. If several beacons are placed in heliocentric orbits, their orbital parameters can be monitored, for example, by ground-based VLBI systems. If the interplanetary space probe receives calibrated signals from these beacons, it is possible to calculate distances from the space probe to the beacons, and on the basis of the spatial coordinates of the beacons – to calculate the spatial location of the space probe. Analog of proposed scheme is the DORIS system, with the only difference that all the beacons on Earth retain their position on the body of the Earth, and beacons in space – change their position. Beacons must be self-contained solar powered devices and an on-Board time service synchronized with UTC over the radio channel. The first "artificial planet" was accidentally created as a result of the miss of the first lunar mission past the moon. Now the launching technique is much better, and it is possible to bring the beacons to heliocentric orbits with any inclination. At high inclination of the beacons, the spatial position of the space probe at the Z-coordinate can be determined with the same accuracy as in the Ecliptic plane.